2004 Energy
The Solutions Network
Rochester, New York

Opportunities to produce electricity using vertical axis wind generators

Jacquelin Déry, P. Eng.
DERMOND INC.

Topic

- The Darrieus type Vertical Axis Wind Turbine (VAWT)
  - So far, among VAWTs, only Darrieus has a well established record of successful operation in the range of a hundred kilowatts to multi-megawatts
  - Significant wind power production requires a wind turbine that sweeps a large area

Table of content

- Technology background
  - Darrieus – National Research Council of Canada
  - Sandia National Laboratories
  - FloWind
  - Hydro-Quebec/NRC – Éole
- Dermond technology
  - Dermond wind turbine
  - WindStor system
- Why VAWT ?

Technology Background

- Georges-Jean-Marie Darrieus's invention:

  TURBINE HAVING ITS ROTATING SHAFT TRANSVERSE TO THE FLOW OF THE CURRENT *(UNITED STATES PATENT 1,835,018 awarded in late 20's)*

- In the 60's, the National Research Council (NRC) of Canada added the troposkien shape. Since then, NRC has continuously supported the development of this technology

Technology Background

- Since the early 70's, the U.S. Government Sandia National Laboratories (SNL) has played a key role by developing mathematical models as well as building and testing a wide variety of VAWTs and blade designs.

17 m Sandia VAWT built in 1975

Technology Background

- Commercial operation of FloWind wind farms installed in California in the 70's, and elsewhere since, continues successfully to this day

100 kW FloWind Wind Farm in California

Technology Background

- In the 80's, Hydro-Québec and NRC (Canada) built and tested the 4 MW Éole designed to comply with utility standards
- Éole was the most advanced wind turbine at the time and remains so to this day
- Over its 6 years testing period, the average overall availability of Éole exceeded 94%

4 MW Éole, Cap-Chat, Québec

Technology Background

- Éole was the first:
  - Wind turbine designed for -40° C operation
  - All steel VAWT
  - Direct driven wind turbine
  - Fully variable speed wind turbine
  - Grid quality electricity wind turbine
  - AC/DC/AC power conversion system

Dermond technology

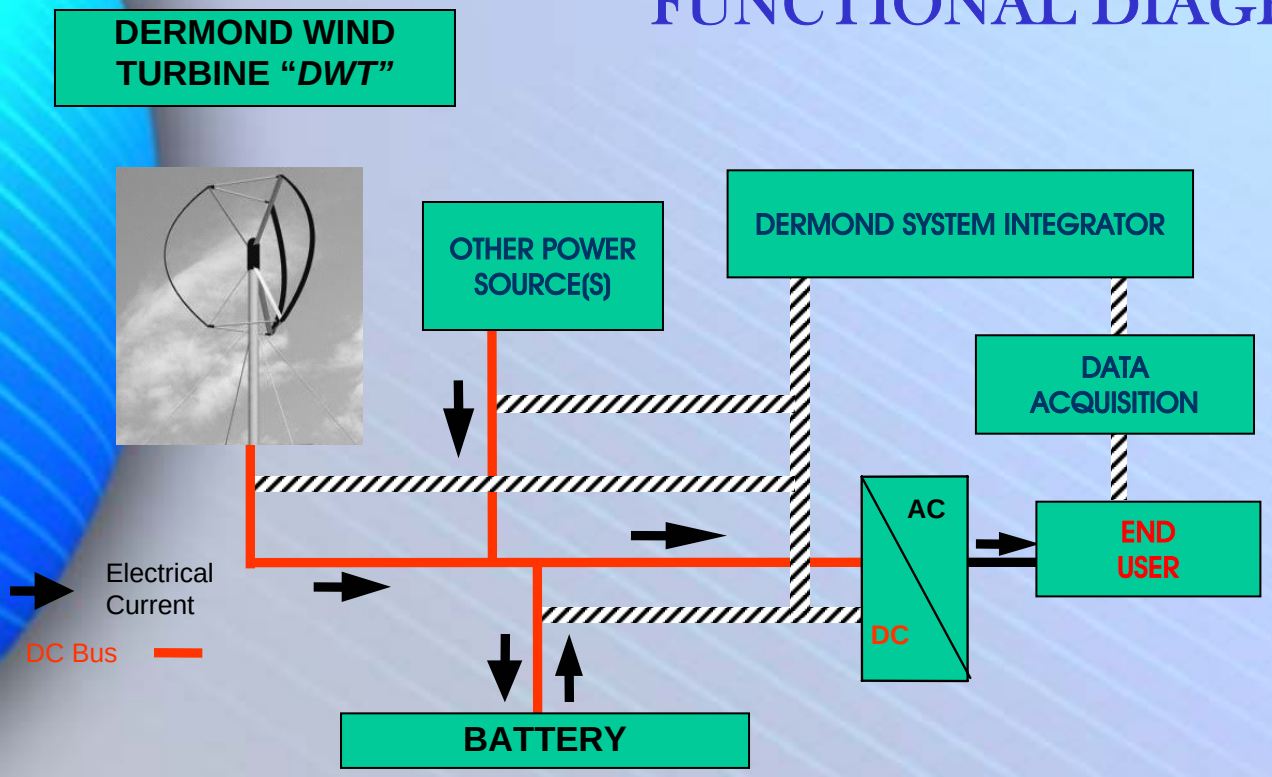
- The Dermond design improves VAWT technology by:
  - Eliminating the guy wire system
  - Mounting the wind turbine on a tower
  - Lowering turbine weight

Dermond wind turbine

Dermond technology

WindStor SM

FUNCTIONAL DIAGRAM



Why Darrieus VAWT ?

- The Darrieus VAWT has two clear and decisive advantages over HAWT technology:
  - Mechanical simplicity
  - Not affected by changes in wind direction

Mechanical simplicity

- Compared with HAWT, Darrieus VAWT has no:
  - Yaw mechanism to turn the rotor into the wind.
  - Nacelle
  - Pitch control mechanism
  - Need for a wind direction sensing element

This eliminates:

  - All risks associated with the failure or malfunction of such equipment
  - All costs of the equipment itself
  - Associated maintenance and operation costs

Not affected by change in wind direction

- VAWT is better adapted than HAWT for applications such as:
  - Open spaces with frequent changes in wind direction
  - Building rooftops
- Unlike HAWT, VAWT doesn't lose energy when wind direction changes and doesn't require power to realign the turbine into the wind

Application where VAWT is better adapted than HAWT

Application where VAWT is better adapted than HAWT